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## **SEEING MUSIC: THE PERCUSSIONISTS' STRATEGIC USE OF GESTURE IN LIVE PERFORMANCE**

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### **ABSTRACT**

Percussionists have long disagreed whether it is possible to use gesture length to control note duration on the marimba when other factors (angle of attack, mallet placement, mallet speed, etc.) are held constant. Some percussionists such as Buster Bailey feel gesture length can control note length, whereas others, such as Leigh Howard Stevens, contend that gesture length 'has no more to do with [note] duration than the sound of a car crashing is dependent on how long a road trip was taken before the accident'. To resolve this debate, stroke preparation and release of short and long notes performed by a world-renowned percussionist were videotaped, then presented to subjects under audio-visual (AV) and audio-alone (A) conditions. In AV, subjects were instructed to make duration ratings based on the auditory information alone.

In the AV condition, ratings were significantly longer for notes produced using long rather than short gestures. However, there was no difference in ratings when presented under the A condition. An acoustic analysis revealed no difference in the length of notes produced using the different gestures. We conclude that while differences in gesture length offer no acoustic control over actual note duration, visual gestures allow the performer to control perceived note duration. In other words, while unable to change the sound of the note, our performer was adept at changing the way the note sounds. These results are intriguing given the unambiguous nature of note duration.

Such a finding suggests visual information plays an important role in music perception. However, in addition to altering perceived duration, visual information lowered sensitivity to differences in note length, as measured by  $d'$ . While vision paradoxically allowed the performer to manipulate perception to better match his intent, this added control came with a hidden cost – the loss of listener sensitivity. Therefore while visual information plays a crucial yet previously undiscovered role in music perception, it remains unclear whether the perceptual benefits outweigh the costs. Implications of these findings for music performance and listening will be discussed, as well as further explorations into the nature of this startling and unusual finding.

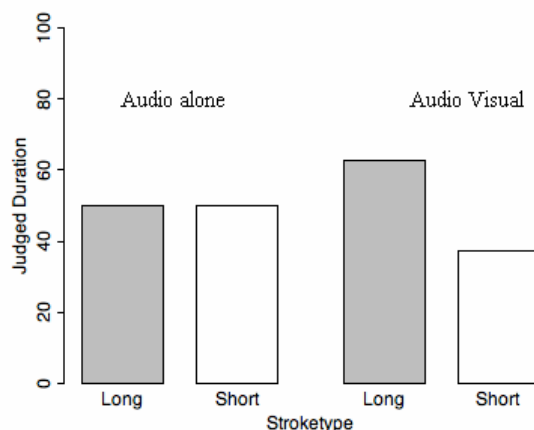
### **EXTENDED ABSTRACT**

#### **Background and Aims**

There has been much research recently examining the role of visual information in the performance and perception of music. A common finding is that vision plays a useful role in communicating along a variety of musical dimensions ranging from conveying degrees of musical tension (Vines, Krumhansl, Wanderley, & Levitan, in press) to musicality and expressivity (Davidson, 1993; Davidson 1995). In particular, the marimba (a pitched keyboard instrument similar to the xylophone) has received a great deal of research attention as it requires the performer to use visually engaging gestures, yet offers a relative lack of control over basic musical parameters such as note duration and articulation. In marimba performances, research has shown gestures used by marimbists are important in communicating both emotion (Dahl & Friberg, 2005) and musical expression (Broughton, 2006). Previous work has also established the strategic use of gesture can overcome acoustic limitations of the marimba by altering the perception of note duration (Schutz & Lipscomb, 2004), a finding which is summarized conceptually in Figure 1.

Clearly, visual information has a great deal to offer audiences and performers alike. What remains unclear is whether these benefits incur any perceptual costs. In other words, is anything lost to the audience as a result of allowing gestures to inform their listening in marimba performances? This study was designed to examine the perceptual costs and benefits of gestures in audio visual music performance situations.

**Figure 1:** Conceptual representation of duration ratings as a function of presentation modality [Results of several experiments are represented conceptually, showing duration ratings differ between notes made with long and short gestures only when visual information is included. These effects were observed despite explicit instructions for subjects to ignore gestures and base responses on the sound alone.]



## Method

### Subjects

54 undergraduate students enrolled in an introductory psychology course at the University of Virginia served as the participants in return for course credit. The students were randomly selected, without any consideration for musical ability, training, experience, or interest.

### Stimuli

The stimuli represent a subset of those used in previous experiments (Schutz & Lipscomb, 2004), showing a world-class percussionist performing a single note at a variety of pitch levels: E1 (~82 Hz), A2 (~220Hz), and D5 (~587 Hz). Two types of gestures were used within each pitch level – ‘natural’ in which the bar was allowed to decay naturally, and ‘damped’ in which the marimba note was artificially shortened. Audio and visual components of long and short gestures were mixed and matched combinatorially with the two types of sounds (natural and damped notes).

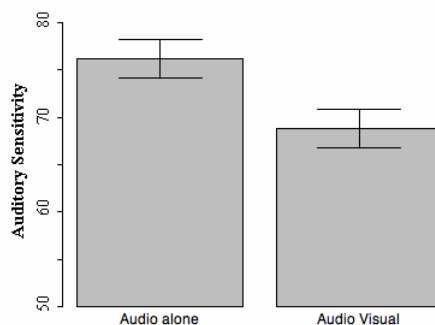
### Procedure

Participants were informed that audio and visual information did not always match, and asked to rate duration of the acoustic note based on what they were hearing alone. They made duration ratings using an unmarked, 101 point slider with endpoints labeled ‘Long’ and ‘Short’. Ratings were made in two conditions: audio-visual (containing both the sound and gesture), and audio-alone (containing only the sound). A modified version of signal detection theory was used to gauge auditory sensitivity independent of gesture. Cases in which natural notes were rated longer than damped were considered ‘hits’ and cases in which the damped were rated longer ‘misses’. Using this procedure ROC curves were constructed for each stimulus condition, and the area under each curve (AUC) used as a measure of sensitivity, identifying the reliability with which subjects were able to correctly distinguish the natural from damped notes.

## Results

In general, subjects were adept at distinguishing between natural and damped notes. However, as shown in Figure 2, sensitivity was significantly higher in the audio alone, rather than audio-visual condition [ $F(1, 639)=26.638, p<.0001$ ].

**Figure 2:** Auditory sensitivity as a function of presentation modality



## Conclusions

Much previous research has shown gestures to be an important aspect of music perception allowing skilled performers to strategically manipulate audience experience. This suggests audiences should pay careful attention to gestures, and that musical situations which ignore visual information (e.g. CDs, radio broadcasts, blind auditions) rob the listener of an important dimension of musical communication. However, these results demonstrate impaired auditory sensitivity during audio visual situations, implying audiences are more attentive to acoustic aspects of a performance when there are not watching. This suggests audiences should ignore gesture information as much as possible in order to preserve acoustic sensitivity. It is doubtful concert audiences routinely close their eyes during live performances to gain a truer sense of the music – rather, visual information is often regarded as ‘part of the show’.

These contradictory results can be reconciled by realizing concert audiences buy tickets to be entertained – to hear the performers tell a story which cannot be told through audio alone. The cinema routinely presents unrealistic situations to the movie-going audience – most viewers are happy to trade the restrictions of reality in order to be entertained by an engaging plot. Likewise, in solo or chamber settings the added dimension of musical communication possible through the strategic use of gesture outweighs the perceptual costs of diminished auditory sensitivity. However, this conclusion applies only to settings in which performers are able to communicate with the audience as individuals. In larger, symphonic settings involving a hundred or more musicians gestures on the part of individual performers are less consequential.

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